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Title of Invention: Ink composition  
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## Specifications

### 1. Title of Invention:

Ink composition

### 2. Claims:

An ink composition for marking pens which contains a solvent and a resin as necessary ingredients and also contains a coloring agent, if necessary; the thermal deformation temperature of said resin ( $18.6 \text{ kg/cm}^2$ ) is  $70^\circ\text{C}$  to  $200^\circ\text{C}$ . and the content of said resin is 20 wt % to 50 wt % of the total ink quantity.

### 3. Detailed Explanation of Invention:

#### Field of Use in Industry

This invention concerns an ink composition for writing instruments by means of which, using existing color films which up to now could only heat-transfer colors for dry-copied drawn lines, hand-drawn lines can be provided to which the colors of said color films can be heat-transferred.

#### Conventional Technology

Color films which can heat-transfer colors only to dry-copied drawn lines are presently on the market: they can change the colors of drawn lines which were dry-copied from black or other colors to different colors.

However, since the colors cannot be transferred except by dry copying, these color films cannot be used if one does not have a dry copier, so that their users have been limited.

Here, the term "color films which can heat-transfer colors" refers to films in which a composition of a coloring pigment, white pigment, and binder resin is applied to a non-

transparent base film. When this color film is placed on dry-copied drawn lines and the film is heated from above, using a heat medium, the binder resin of the copy lines is melted and becomes adhesive, showing affinity with the film coating surface; therefore, these two adhere to each other, and the coating surface is pulled off of the base film. At this time, the aforementioned white pigment hides the dry-copied lines and the colored pigment colors them, so that they can be changed to the desired color.

However, with presently-available commercial writing instruments, it is not possible to provide drawn lines which can be colored by these color films.

#### Problems Which This Invention Seeks to Solve

The inventors performed careful investigations, as a result of which they discovered that, in order to make the heat transfer color film mechanism for dry-copied drawn lines possible with lines made by writing instruments, the following conditions are required: a large quantity of the resin ingredient of the drawn lines must be present on the paper surface, the resin ingredient of drawn lines must melt in a specific temperature range and become adhesive, the coating film of the drawn lines must have a sufficient strength, and it must have an affinity with the coating surface. Thus, this invention was achieved.

That is, this invention is an ink composition for marking pens which contains a solvent and a resin as necessary ingredients and also contains a coloring agent, if necessary; the thermal deformation temperature of said resin ( $18.6 \text{ kg/cm}^2$ ) is  $70^\circ\text{C}$  to  $200^\circ\text{C}$ , and the content of said resin is 20 wt % to 50 wt % of the total ink quantity.

Examples of the resin used in this invention are polystyrene homopolymers, hydrogenated styrene resins, styrene-isobutylene copolymers, styrene-butadiene copolymers, ABS resins, acrylonitrile-styrene-acrylic acid ester triple copolymers, styrene-acrylic copolymers, acrylonitrile-acrylic rubber-styrene triple copolymers, acrylonitrile-chlorinated polyethylene-styrene triple copolymers, acrylonitrile-EVA-styrene copolymers, styrene-p-chlorostyrene copolymers, styrene-propylene copolymers, styrene-butadiene cross-linked polymers, styrene-allyl alcohol copolymers, styrene-maleic acid ester copolymers, styrene-maleic anhydride copolymers, styrene-isobutylene copolymers, styrene-propyl 3-N,N-dieethylaminoacrylate copolymers, poly(methyl methacrylate), ethyl methacrylate, n-butyl methacrylate, glycidyl

methacrylate, fluorine-containing acrylate, methylene methacrylate-butyl methacrylate copolymers, ethyl acrylate-acrylic acid copolymers, styrene-diedethylamino-ethyl methacrylate copolymers, styrene-butadiene-acrylic acid ester copolymers, styrene-butadiene-chlorinated paraffin copolymers, styrene-methyl methacrylate copolymers, styrene-methyl methacrylate copolymers, styrene-n-butyl methacrylate copolymers, styrene-methyl methacrylate-n-butyl methacrylate copolymers, styrene-methyl methacrylate-N-(ethoxyethyl)acrylamide copolymers, styrene-glycidyl methacrylate copolymers, styrene-dimethylamino-ethyl methacrylate copolymers, styrene-butadiene-dimethyl-aminoethyl methacrylate copolymers, styrene-acrylic acid ester-maleic acid ester triple copolymers, styrene-methyl methacrylate-2-ethylhexyl acrylate copolymers, styrene-n-butyl acrylate-ethyl glycol methacrylate copolymers, styrene-n-butyl methacrylate-maleic anhydride copolymers, styrene-butyl methacrylate-isobutyl maleic acid half-ester-divinylbenzene copolymers, styrene-n-butyl acrylate-4-hexafluorobutyl methacrylate copolymers, etc. These can be used individually or in blends with each other.

The resin used is one which has a thermal deformation temperature ( $18.6 \text{ kg/cm}^2$ ) of  $70^\circ\text{C}$  to  $200^\circ\text{C}$ . If the thermal deformation temperature ( $18.6 \text{ kg/cm}^2$ ) is lower than  $70^\circ\text{C}$ , it will soften even in a natural environment, and the drawn lines may become tacky, which is not desirable, and the lines will become weak due to the extra heat after the heat transfer, so that it will be difficult to peel the coating surface from the film. If the thermal deformation temperature ( $18.6 \text{ kg/cm}^2$ ) is higher than  $200^\circ\text{C}$ , the temperature of existing heating objects (e.g., household items) cannot be raised to this temperature, and the resin ingredient of the drawn lines will not melt, so that they cannot be transferred.

The quantity of the resin added should be 20 wt % to 50 wt % of the total quantity of the ink, preferably 25 wt % to 45 wt %. If the resin ingredient is less than 20 wt %, there will be a great amount of penetration of the resin ingredient into the paper surface and the quantity of resin remaining on the drawn lines, as well as its thickness, will be small, so that the adhesive force will be insufficient, and it will not adhere to the coating surface of the film and cannot be transferred. If the quantity of the resin ingredient is greater than 50 wt %, the viscosity of the ink itself will become too great, and the ink will not easily flow out of the writing instrument, so that it will be difficult to draw lines on the paper surface.

The aforementioned resin can be used in the ink in the form of a solution or an emulsion. It is especially advantageous to use an emulsion from the standpoints of the high resin concentration and the low viscosity.

In the ink compounding, one can use dye or pigment coloring agents, as desired. The dyes or pigments used can be publicly-known, commercial ones, but it is desirable to select ones which have good miscibilities and do not react with the aforementioned resins.

#### Actual Examples

This invention will be explained in more detail below by means of actual examples, but it is not limited by these actual examples.

The compositions of the inks formulated and the effects of this invention are shown in the tables. After the compositions shown in the tables were mixed, they were stirred thoroughly and uniform inks were obtained. The evaluations were performed by filling bulb-type markers with the prepared inks and drawing on paper, after which natural drying was performed. The color film (Letraset Co., Color Tag (*kanzai tagu*)) was placed on the drawn lines and a heating body was applied at a temperature of 170°C, heating the drawn lines from above the color film. The colors were transferred, and the state of the transfer was judged by eye.

#### Actual Example 1

	Quantity compounded (wt %)
Oil-soluble dye	2
Polystyrene homopolymer (Esso Co.; Pikkorasuchikku D 127)	30
Toluene	68
State of transfer	Good

### Actual Example 2

	Quantity compounded (wt %)
Water-soluble dye	2
Styrene-acrylic copolymer emulsion (Johnson Polymer Co.; Johncryl [Jonkuriu]-89J (solids 49%))	78
Pure water	20
State of transfer	Good

### Effectiveness of Invention

As mentioned above, by using the ink of this invention, it has become possible to use color films, which previously could only be used to color copied drawn lines, to color hand-drawn lines as well.

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